

Checklist of amphibians of Nayarit, western Mexico

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ABSTRACT: Nayarit is one of the Mexican states where less has been published regarding the fauna of amphibians. The aim of this work was to generate a list of amphibians of Nayarit through literature review and fieldwork. The amphibian fauna of Nayarit consists of 37 species, belonging to 21 genera, 10 families, and two orders. Among these 37 species, 36 are native, 21 are endemic to Mexico, and one is exotic (the American bullfrog *Lithobates catesbeianus*). In total, nine species are under the category of “Special Protection” and one as “Endangered” by Mexican laws and four (one as “Endangered” and three as “Vulnerable”) under international laws of protection. In the near future, our expectation is that more species will be added to the list of species of amphibians in Nayarit, as more fieldwork remains to be done in some remote and unexplored areas of the state.

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INTRODUCTION

Mexico ranks fifth among the countries with highest amphibian diversity in the world. It is home to 376 currently recognized species, plus at least 22 proposed new species that are currently being described (Ochoa-Ochoa *et al.* 2013; Wilson *et al.* 2013; Parra-Olea *et al.* 2014). The Mexican states with the highest species diversity are Oaxaca, Chiapas and Veracruz (Casas-Andreu *et al.* 1996; Muñoz-Alonso *et al.* 2013; Parra-Olea *et al.* 2014), whereas other states such as Baja California, Baja California Sur and Coahuila are considerably less diverse. These differences can be attributed to the complex physiographic features present in the states with greatest diversity. However, those states have also been most extensively surveyed, so a degree of variation in species diversity could be due to sampling bias.

Nayarit, in western Mexico, presents a diverse range of ecosystems (which may contribute to high species diversity) but whose amphibians have been poorly studied. Flores-Villela *et al.* (2004) stated that the coastal region of western Nayarit is relatively well studied, but the mountainous eastern region of the state is poorly known except in the vicinity of the Tepic-Guadalajara highway. Until about 50 years ago, very little was known about the fauna in the state. Smith and Taylor (1948) and Lewis and Johnson (1955) reported the first major collections and shortly thereafter more sampling occurred (Zweifel 1959). McDiarmid (1963) added important comments on the highlands of the eastern part of the state, and both Zweifel (1960) and McDiarmid *et al.* (1976) provided information on the herpetofauna of the Tres Marias Islands. In the last 20 years, Mexican researchers have reported isolated geographic records

(Casas-Andreu 1992; Canseco-Márquez *et al.* 2007; de la Torre *et al.* 2010; Ahumada-Carrillo *et al.* 2013) to the area. Despite this abundance of research, there has not been an updated list of amphibians published for Nayarit since Smith and Taylor (1948) presented the earliest known list of amphibians for the state, including 19 species.

The objective of this work is to compile an updated checklist of the amphibians of Nayarit, to provide a starting point to encourage future research within the state’s territory.

MATERIALS AND METHODS

Study site

Nayarit is located in the northwest of Mexico, between 23°05′ and 20°36′ N latitude and 103°43′ and 105°46′ W longitude. Its land area is 27,857 km², which represents 1.4% of the total land area of Mexico. Sinaloa and Durango border Nayarit in the north; Durango, Zacatecas and Jalisco in the east; Jalisco in the south; and the Pacific Ocean in the west. The biogeographic provinces present in the state are: Sierra Madre Occidental, Pacific Coastal Plain, Mexican Volcanic Belt and Sierra Madre del Sur (Figure 1; CONABIO 1997). The average annual temperature in the state is 25°C, average minimum temperatures are around 12°C in January and average maximum temperatures may be slightly higher than 35°C during the months of May and June. Most rainfall occurs in the summer, during the months of May to September, and the average rainfall in the state is 1,100 mm per year. The surface hydrology of Nayarit is comprised of 21 major rivers, seven ponds, a stream, and three artificial reservoirs (INEGI 2011).

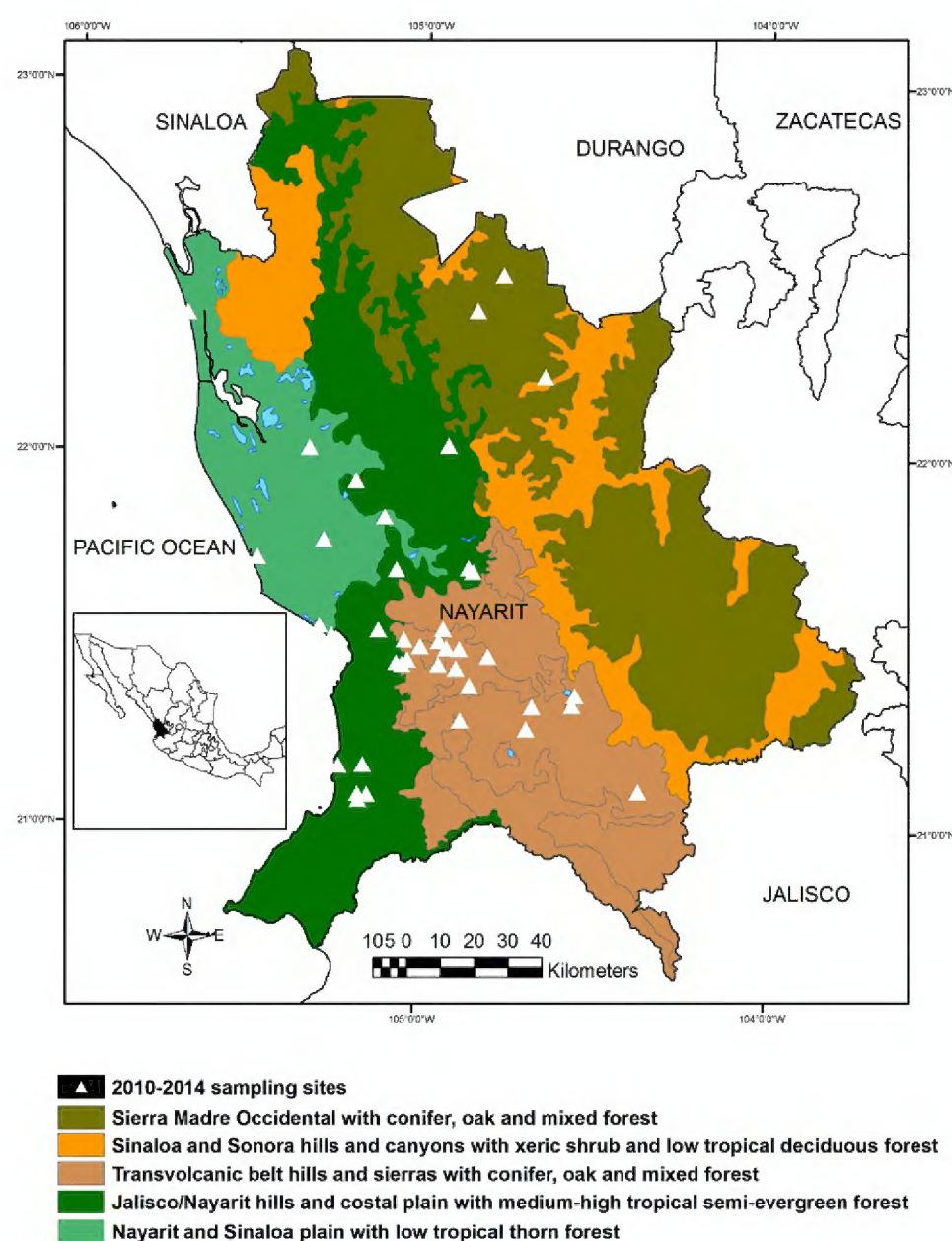


FIGURE 1. Sampling sites recorded between 2010 and 2014, in the state of Nayarit, western Mexico.

Data collection

This checklist is based upon an extensive review of publications in specialized journals in Herpetology including: *Amphibia-Reptilia*, *Copeia*, *Herpetologica*, *Herpetological Journal*, *Herpetological Monographs*, *Herpetological Review*, and the *Journal of Herpetology*. We also search other journals that it is known to publish information on the species distribution: *Check List*, *Revista Mexicana de Biodiversidad*, *Acta Zoológica Mexicana*. Finally, we used the search engine Google Scholar updated to June 2014; we searched using the keywords amphibians OR frogs OR toads OR salamander AND Nayarit. Using the HerpNet application (<http://www.herpnet2.org>), we searched for amphibian records including the words: amphibians OR Anura OR Caudata AND Nayarit. The search yielded a list of museum records filtered to use only registers that included geographical coordinates. These records were then projected into Google Earth, and those whose coordinates were outside the limits of Nayarit were eliminated. We also include information derived from our fieldwork in Nayarit (2010–present). The fieldwork includes 40 sampling sites (Figure 1) across the four physiographic provinces in the state: Sierra Madre Occidental, Pacific coastal plain, Transvolcanic Belt, and Sierra Madre del Sur. Data collection in the field was opportunistic and took place mainly during the rainy seasons. We used a mixture of techniques, including Visual Encounter Surveys (VES) that involved walking in specific spots looking for amphibians in appropriate habitats, surveys at breeding sites, road sampling during rainy nights, and auditory census.

Data analysis

The original list obtained was refined to remove numerous synonyms and was updated following Frost *et al.* (2006), Pyron and Wiens (2011) and Streicher *et al.* (2012). The protection status of each species is according to the current Mexican NOM-059-2010 (SEMARNAT 2010) and international (IUCN 2014) listings. We also used these resources to identify endemic and introduced taxa. We use photographs as vouchers of our observations in the field; these photographs were deposited in the University of Texas at Arlington Digital Image Collection (UTADC). Species that we were not able to observe in the field were confirmed based on the bibliographic review of specimens deposited in scientific collections. A list of the scientific collections where each species is deposited is presented on the Appendix I.

RESULTS

We obtained a final list including two orders, 10 families, 21 genera and 37 species (Table 1) representing 9.8% of Mexican amphibians (376 species; Parra-Olea *et al.* 2014). Thirty-six species were reported from literature; from this total we observed 27 species in the field, from which one species (*Spea multiplicata*) is a new record for the state. *Spea multiplicata* was recorded by VHL on 23 May 2014 in the Municipality of Jala, in the Jala-Los Aguajes road (21°6'18.40" N, 104°21'46.70" W), 1870 m elevation, (UTA Digital Image Collection: UTADC 8136).

Endemism and conservation status

Twenty-one species of amphibians with part of their distributions in Nayarit are endemic to Mexico. Although there are no state endemics, several taxa have a reduced distribution, including parts of Nayarit state (*e.g.*, Eleutherodactylidae). In total, eleven species are included in national and/or international conservation lists. Eight are listed as “under special protection” (Pr) and one as “Endangered” (A) by Mexican NOM-ECOL-059-2010 (SEMARNAT 2010); three as “Vulnerable” (VU), and one as “Endangered” (EN) (IUCN 2014). Only two species (*Lithobates megapoda* and *Pseudoeurycea belli*) are listed on both national and international conservation lists.

DISCUSSION

The total number of species we obtained surpasses the previously reported number of amphibian species for Nayarit (30 species, list not present), in the most recent study of Mexican amphibian diversity by Parra-Olea *et al.* (2014). Besides the increase of seven species presented by us, it is noteworthy that Parra-Olea *et al.* (*op. cit.*) consider that all species of amphibians in Nayarit belong to the order Anura (frogs and toads), with Caudata and Gymnophiona being absent. Our review showed that the salamander *Ambystoma rosaceum* (Caudata: Ambystomatidae) is present in Nayarit, collected at Sierra de Alica (Canseco-Márquez *et al.* 2007).

In a recent survey (February, 2014), VHL collected four individuals of *A. rosaceum* at Santa Teresa, Municipality of Del Nayar (UTADC 8102). Also, we include *Pseudoeurycea belli* (Caudata: Plethodontidae) in the checklist, because it was cited by Gadow (1905), Dunn (1926), Smith and Taylor (1948) and Parra-Olea *et al.* (2005) as present in

Nayarit. However, we were not able to find records of this species from Nayarit in any scientific collection.

At the regional level (western Mexico), the amphibian fauna of Nayarit can be considered diverse; the state has an area of 27,857 km² (23rd largest in Mexico), and we reported 37 species of amphibians (36 native plus one exotic). Comparatively, Sinaloa has 57,365 km² (18th

largest in Mexico) and 36 species of amphibians (Parra-Olea *et al.* 2014), the same number of native species as Nayarit. Durango has a surface area of 123,317 km² (4th largest in Mexico) and is home to 33 species of amphibians (Valdes *et al.* 2013), four fewer than Nayarit despite being twice as large. Zacatecas has an extension of 75,284 km² (8th largest in Mexico), and 13 species of amphibians have

TABLE 1. Amphibians of Nayarit, Mexico. Conservation status (Status) according to NOM-ECOL 059-2010 (SEMARNAT 2010): A = threatened, Pr = Special protection; and the International Union for Conservation of Nature (IUCN): VU* = vulnerable. “Endemic” refers to endemism level E = Endemic, N = Non-endemic and EX** = exotic. “Observed in the field” refers to species observed by the authors of this study in the field and pictures deposited as vouchers in the University of Texas at Arlington Digital Image Collection (UTADC). “Reference” refers to publication from which data were obtained.

TAXON	STATUS	ENDEMIC	OBSERVED IN THE FIELD	REFERENCE
CLASS AMPHIBIA				
ORDER ANURA				
Family Bufonidae				
<i>Anaxyrus kelloggi</i> (Taylor, 1936)		E		Oliver-López (2009)
<i>Incilius marmoreus</i> (Wiegmann, 1833)		E	X	Oliver-López, (2009)
<i>Incilius mazatlanensis</i> (Taylor, 1940)		E	X	Zweifel (1960)
<i>Incilius occidentalis</i> (Camerano, 1879)		E	X	McDiarmid (1963)
<i>Rhinella marina</i> (Linnaeus, 1758)		N	X	McDiarmid (1963)
Family Craugastoridae				
<i>Craugastor augusti</i> (Dugès, 1879)		N	X	McDiarmid (1963)
<i>Craugastor hobartsmithi</i> (Taylor, 1936)	EN*	E	X	Lewis and Johnson (1955)
<i>Craugastor occidentalis</i> (Taylor, 1941)		E	X	McDiarmid (1963)
<i>Craugastor pygmaeus</i> (Taylor, 1937)	VU*	N	X	Ahumada-Carrillo <i>et al.</i> (2013)
<i>Craugastor vocalis</i> (Taylor, 1940)		N	X	Zweifel (1959)
Family Hylidae				
<i>Agalychnis dacnicolor</i> (Cope, 1864)		E	X	McDiarmid (1963)
<i>Diaglena spatulata</i> (Günther, 1882)		E		Woolrich-Piña <i>et al.</i> (submitted)
<i>Exerodonta smaragdina</i> (Taylor, 1940)	Pr	E	X	McDiarmid (1963)
<i>Hyla arenicolor</i> Cope, 1866		N	X	Duellman (1970)
<i>Hyla eximia</i> Baird, 1854		E	X	Duellman (1970)
<i>Plectrohyla cf bistincta</i> (Cope, 1877)	Pr	E	X	Duellman (1970)
<i>Smilisca fodiens</i> (Boulenger, 1882)		N	X	Duellman (1970)
<i>Smilisca baudinii</i> (Duméril & Bibron, 1841)		N	X	Lewis and Johnson (1955)
<i>Tlalocohyla smithii</i> (Boulenger, 1902)		E	X	Lewis and Johnson (1955)
<i>Trachycephalus thyponius</i> (Laurenti, 1768)		N		Shannon and Humphrey (1957)
Family Eleutherodactylidae				
<i>Eleutherodactylus nitidus</i> (Peters, 1870)		E	X	Dixon (1957)
<i>Eleutherodactylus pallidus</i> (Duellman, 1968)		E	X	Duellman (1958)
<i>Eleutherodactylus teretistes</i> (Duellman, 1958)	Pr	E	X	Duellman (1958)
Family Leptodactylidae				
<i>Leptodactylus melanonotus</i> (Hallowell, 1861)		N	X	Lewis and Johnson (1955)
Family Microhylidae				
<i>Gastrophryne mazatlanensis</i> (Taylor, 1943)	Pr	N		Smith and Taylor (1948); Streicher <i>et al.</i> , (2012).
<i>Hypopachus ustus</i> (Cope, 1866)		N		Smith and Taylor (1948)
<i>Hypopachus variolosus</i> (Cope, 1866)		N	X	de la Torre <i>et al.</i> (2010)
Family Ranidae				
<i>Lithobates catesbeianus</i> (Shaw, 1802)		N, EX**	X	Casas-Andreu <i>et al.</i> (2001)
<i>Lithobates forreri</i> (Boulenger, 1883)	Pr	N	X	Frost and Bagnara (1976)
<i>Lithobates magnaocularis</i> (Frost & Bagnara, 1974)		E		Frost and Bagnara (1976)
<i>Lithobates megapoda</i> (Taylor, 1942)	Pr, VU*	E		Zweifel (1959)
<i>Lithobates psilonota</i> (Webb, 2001)		E		Canseco-Márquez <i>et al.</i> (2007)
<i>Lithobates pustulosus</i> (Boulenger, 1883)	Pr	E	X	McDiarmid (1963)
Family Scaphiopodidae				
<i>Scaphiopus couchii</i> Baird, 1854		N		Degenhardt <i>et al.</i> (1996)
<i>Spea multiplicata</i> (Cope, 1863)		N	X	This study
ORDER CAUDATA				
Family Ambystomatidae				
<i>Ambystoma rosaceum</i> Taylor, 1941	Pr	E	X	Canseco-Márquez <i>et al.</i> (2007)
Family Plethodontidae				
<i>Pseudoeurycea bellii</i> (Gray, 1850)	A, VU*	E		Gadow (1905), Dunn (1926), Smith

been recorded there (Parra-Olea *et al.* 2014). Finally, Jalisco (78,588 km²; 7th largest in Mexico) has 43 species of amphibians (Parra-Olea *et al.* 2014) making it more species-rich than Nayarit. We conclude that, despite its small size, Nayarit can be considered an important region of amphibian diversity because is equally or more diverse than most states in western Mexico with the exception of Jalisco, which is bigger than Nayarit and has seven more species.

Only one species listed in the scientific literature as occurring in Nayarit (*Pseudoeurycea belli*) was neither observed in the field nor documented from collections. However, we included it into the final list because several authors mentions its presence in the state and also because habitat adjacent populations of *P. belli* in Jalisco occurs in Nayarit (personal observation). Although Gadow (1905), Dunn (1926), Smith and Taylor (1948) and Parra-Olea *et al.* (2005) mention that *P. belli* is distributed “in the Sierra Madre Occidental from Nayarit and Zacatecas in the northwest...”, no supporting material is presented. We were not able to find any collection reports that confirmed the presence of this species in the state. However, there are nearby records in San Sebastian del Oeste, Sierra del Aguila and Sierra los Huicholes, Jalisco (15–20 km from the Nayarit border; ITAC personal observation). The habitat in these localities is continuous with similar habitats in the state of Nayarit and makes the presence of this species very probable.

Final comments

This work is the first comprehensive compilation of published information on amphibians in Nayarit. This constitutes the baseline of information and future fieldwork to the unexplored municipalities of Sierra Madre Occidental and other regions could provide more information and add other taxa to the list. The previous statement is based on the 2014 new municipality records and extension range for species as *Ambystoma rosaceum* and *Plectrohyla bistincta* (Luja and Grünwald, submitted paper), and from our recent record of *Spea multiplicata* as a new state record reported in this paper.

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- AUTHORS' CONTRIBUTION STATEMENT:** VHL and ITAC collected the data, VHL, ITAC, PPC and EFE wrote the text, VHL made the analysis.
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- APPENDIX 1.** List of voucher specimens cited by literature deposited on scientific collections.
- Acronyms = **AMNH:** American Museum of Natural History, New York, NY; **ASU:** Arizona State University, Phoenix, AZ; **BYU:** Monte L. Bean Museum, Brigham Young University, Provo, UT; **CAS:** California Academy of Sciences, San Francisco, CA; **CM:** Carnegie Museum of Natural History, Pittsburgh, PA; **CNAR:** Colección Nacional de Anfibios y Reptiles, Instituto de Biología, UNAM, Mexico, DF; **CU:** Cornell University Museum of Vertebrates, Ithaca, NY; **FMNH:** Field Museum of Natural History, Chicago, IL; **IBUNAM:** Instituto de Biología, UNAM, Mexico, DF; **KU:** University of Kansas Natural History Museum and Biodiversity Research Center, Lawrence, KS; **LACM:** Natural History Museum of Los Angeles County, Los Angeles, CA; **LSU:** Louisiana Museum of Natural History, Louisiana State University, Baton Rouge, LA; **MCZ:** Museum of Comparative Zoology, Harvard University, Cambridge, MA; **MPM:** Milwaukee Public Museum, Milwaukee, WI; **MVZ:** Museum of Vertebrate Zoology, University of California, Berkeley, Berkeley, CA; **MZFC:** Museo de Zoología, Universidad Nacional Autónoma de México, Mexico, DF; **OSU:** Oregon State University Herpetological Collection, Corvallis, OR; **SDSNH:** San Diego Natural History Museum, San Diego, CA; **TCWC:** Texas Cooperative Wildlife Collection, Texas A & M University, College Station, TX; **UAZ:** Amphibian and Reptile Collection, University of Arizona, Tucson, AZ; **UCM:** University of Colorado Museum, Boulder, CO; **UMNH:** Utah Museum of Natural History, Salt Lake City, UT; **USNM:** Smithsonian National Museum of Natural History, Washington, D.C.; **UTA:** Amphibian and Reptile Diversity Research Center, University of Texas at Arlington, Arlington, TX; **UTADC:** University of Texas at Arlington Digital Image Collection, Arlington, TX; **UTEP:** The Centennial Museum, University of Texas at El Paso, El Paso, TX.
- Anaxyrus kelloggi:* **KUH** 37840–37853; **LACM** 8685, 8686, 59422, 87772, 87773; **UTEP** 5771, 5772.
- Incilius marmoreus:* **CAS** 169693–169695, 91975; **IBUNAM** AR3844, AR3845, AR3846, AR3847, AR3848, AR8254, AR8268, AR3849, AR3871, AR9363, AR3872, 3874, AR3873, 3875, 3877, 9362, AR3876, 3878, AR7889, AR7899; **KU** 37645–47; **LACM** 25403; **MSUM** HE.11990, HE.10527; **LSU** 63624; **MVZ:** 70235–70237, 76098; **UTEP** 5851; 5855, 5856, 5862–5864; Fieldwork of the present study: **UTADC** 8150.
- Incilius mazatlanensis:* **CAS** 132511, 86125, 86126, 95643, 95644, 95645, 95646–9565, 95652–95655, 95665, 95666, 95702, 97046–97052, 97075, 97303, 97360–97362, 97369–97372, 97380, 97735, 99160, 99161, 99162, 99169, 181, 99182, 99232, 99251, 99258, 99259, 99452, 99453, 99485, 99486, 99504, 99518, 99519, 99520, 99520–99522, 99523–99524, 99525–99526, 99527, 99528, 99529, 99530, 99531, 99532, 99533, 99534, 99535, 99536, 99538, 99540–99541, 99543–99544, 99546, 99547, 99556, 99560, 99561, 99564, 99565, 99568, 99571–99572, 99573, 99575, 99577, 99579, 99581–99582, 99585, 99587–99588, 99589, 99592, 99593, 99594, 99595–99598, 99696, 99697–99698, 17013–17016, 17020–17028, 17017–17018, 17019, 17029–17030, 1779–1780, 1798–1799, 1781–1788, 1800; **CM** 51126–51131; **IBUNAM** AR5870, AR7884, AR7890, AR7898, 7900, AR8134, AR8138, AR8139, AR8264, AR8265, AR8266, AR8267, AR8296, AR8325, AR8326, AR8327, AR8542, AR9364, 9367, 9368, AR9365, 9366, AR9369, AR9370; **LACM** 6178, 8687–8695, 11923, 12001–12002, 25406–25411, 74590, 87858, 87849, 87880–87881, 87882, 87883, 87884, 87885–87886, 87890–87895, 87898, 87887–87889, 7896, 87897, 87899–87902, 87903–87911, 135403; **LSU** 30191–30198, 37736, 37747, 37737, 37738, 37747–37750, 37763, 37762, 37764–27767, 63633–63637, 63638; **MCZ** A-28358, A-82793; **KU** 27587, 27588–27601, 29811, 29830, 29831, 29833, 29836, 29837, 63334, 67812–67818, 73799, 73800, 78293, 78293, 78294, 78295; **MSUM** HE.11985, 11984, HE.7150–7152, HE.8830, HE.487, HE.11983; **MVZ** 52140, 52141, 71196, 71197, 76099, 76100; **SDNHM** 48244; **UAZ** 11732–11747, 11760, 11761, 11802, 30101; **UAZ** 31817, 33248, 37868; **UCM** 15772–15796, 8184–8210; **USNM** 46948, 238069–238073, 238074–238078, 238079–238081, 134259, 161262, 46949; **UTEP** 5866, 5867–5869, 5871–5873, 14271; **TCWC** 12516, 23930, 12517, 12518, 12519–12522, 23931, 64237, 74449–74463; Fieldwork of the present study: **UTADC** 8151.
- Incilius occidentalis:* **CAS** 169679; **IBUNAM** AR8253, AR8850, 9371; **KU** 67825; **LACM** 1789–1802; **LSU** 35119–35121; **MCZ** A-85401; **MSUM** HE.10521–HE.10523; 186794; **TCWC** 61718; **UAZ** 38216–38227; **USNM** 47171; **UTEP** 6531, 6951–6952; Fieldwork of the present study: **UTADC** 8168.
- Rhinella marina:* **CAS** 169683–169685, 3138–3140, 3219, 95592, 97363, 97364, 95641, 97379, 98052, 99051, 99082, 99083, 99084, 99092, 99093, 99094, 99149, 99150, 99203, 99204, 99205, 99488, 99489; **KU** 29854, 29856, 29860, 29861, 29855, 29859, 62248, 73788; **LACM** 1777, 1778, 1797, 25402, 87741–87743; **LSU** 30189, 30190, 30919, 30930, 30934, 63580; **MSUM** HE. 11419, HE.4198; **MVZ** 70238, 70239; **SDNHM** 49970–49972; **TCWC** 12484; **UAZ** 11536, 11567, 11580, 11581, 42172; **UCM** 45406–45411, 46089, 46090, 49873, 50865–50870; **UTEP** 5809, 5812; Fieldwork of the present study: **UTADC** 8157.
- Craugastor augusti:* **AMNH** 106878–106879, 68037. Fieldwork on this study: **UTADC** 8138.
- Craugastor hobartsmithi:* **CAS** 99052, 17448–17449; **IBUNAM** AR8234, AR8235; **KU** 29767; **PSM** Herp-07591–07599, Herp-07600–07604; Fieldwork of the present study: **UTADC** 8139.
- Craugastor occidentalis:* **CAS** 95723, 95724; **IBUNAM** AR7877–AR7878; **KU** 29823, 29825–29826; **LACM** 1804, 8708, 37252; **LSU** 67972; **MSUM** HE.10543, 7309–7310, 10496; **UTEP** 6616–6617, 6619–6620, 6953, 6960; Fieldwork of the present study: **UTADC** 8140.
- Craugastor pygmaeus:* **CAS** 95663, 99231. Fieldwork of the present study: **UTADC** 8141.

Craugastor vocalis: **KU** 28140–28141, 63336–63337–63343, 63338, 86602; **CAS** 91982–91983, 95714, 95715, 99053–99058, 99062–99063, 99097–99114, 99222–99230, 99249, 99260, 99262–99264; **LACM** 1805–1806, 1829–1834; **MVZ** 72122–72126; **UTEP** 6534–6538, 6621, 6880, 6881; **UAZ** 37655–37657, 38388; Fieldwork of the present study: **UTADC** 8142.

Agalychnis dacnicolor: **CAS** 92010–92016, 95679, 95726–95729, 95730, 97053–97063, 99095, 99163, 99164, 99180, 99183, 99202, 99255, 99490, 99537, 99553, 99554, 99558, 99566, 99567, 99569, 99570, 99576, 99578, 99584, 99590, 99591, 17032; **CM** 39923, **CM** 51125; **IBUNAM** AR7881, AR8143, AR 8232, AR8233, AR8304, 8383, AR9377, AR9378–9381; **KU** 28100, 50634–50636, 62329, 62330, 62331, 46953, 238017–238022, 238118–238120, 238121–238126, 238127–23829, 46954, 46955 “Acaponeta”; **LACM** 1808, 1841–1847, 1867–1892, 6334, 12261, 12262, 74750, 90087, 90088, 90100–90102, 91729, 90089–90091, 90092–90094, 90095–90099; **LSU** 30188, 38071, 38072, 38074–38076, 67598, 67599–67604, 78479; **MVZ** 76104; **SDNHM** 68150–68152; **UAZ** 12805–12809, 12855, 12856, 14370, 14371, 30100, 31818–31821, 33392, 33423; **UCM** 15850–15853; **TCWC** 12304, 20783, 64238, 74866, 74867; **UTEP** 5452; Fieldwork of the present study: **UTADC** 8137.

Diaglena spatulata: **SDNHM** 68148; **UTEP** 6623, 6624.

Exerodonta smaragdina: **CAS** 91984–92007, 99491; **LACM** 1807, 1835–1839, 8715, 25350; **UTEP** 6990–6992, 8035. Fieldwork of the present study: **UTADC** 8146.

Hyla arenicolor: **CAS** 99235; **KU** 37738, 37739; **LACM** 88667; 88668–88671, 88674, 88675, 88672, 88673; **UAZ** 13295; Fieldwork of the present study: **UTADC** 8147.

Hyla eximia: **CAS** 132162, 136719–136739, 169653, 169663–169669, 169696–169699, 3145–3160, 94886, 95680–95691, 95725, 97310–97316, 97736, 99147, 99234, 99454, 99455, 99461–99480, 99508–99510, 17038, 17039; **KU** 29801, 29803, 19805, 154402; **LACM** 2096–2099, 36893–36896, 89230–89232, 89233, 89234–89236, 89237–89239, 89240–89243; **LSU** 37610–37617, 37630–37636; **MSUM** HE.117; **MVZ** 71223; **TCWC** 12343–12345; **UAZ** 13483, 13489, 13490–13492; **USNM** 46384, 46830–46833, 65889, 65890; Fieldwork of the present study: **UTADC** 8148.

Plectrohyla bistincta: Fieldwork of the present study: **MZFC** 28147, 28166, 28167; **UTADC** 8156.

Smilisca baudinii: **CAS** 132872, 169674, 3144 95656–95658, 95669, 95670, 95676, 97040–97045, 97461, 97400–97460, 99185, 99457, 99539, 99545, 99548, 99552, 99555, 99557, 99559, 99563, 99692–99694, 17034–17037; **CM** 51122–51124; **IBUNAM** AR5449, 5450, AR7880, AR7891, AR8142, AR8148, AR8307, AR9373, AR9374, AR9375, 9376; **KU** 28087, 37624, 62360–62362, 67786, 73909, 126075; **LACM** 13153, 74751, 90270–90272, 25614, 5115, 90265–90269, 90273, 90274–90277, 90278–90290, 90292, 90293, 90294, 90295, 90296, 90297–90300, 178363; **LSU** 74981–74982, 74984–74995, 74997, 74998, 75001, 745002, 74996, 36057, 37855, 37857–37859; **MSUM** HE.11475, 7299, 11973–11975, 4230–4232, 11982; **MVZ** 70231, 71224; **PSM** Herp-07541; **UAZ** 13362, 13416, 13417; **UCM** 15869–15871; **USNM** 238104–238106, 51408, 147983, 238107–238113, 288114; **TCWC** 12298, 12299, 74885–74887; **UTEP** 6984, 8446, 8478; Fieldwork of the present study: **UTADC** 8158.

Smilisca fodiens: **CAS** 95671, 95672, 95673, 95674, 95675, 97068, 97684–97720, 99252, 99256, 99257, 99458–99460, 99514, 99515, 99574, 99580, 99586, 17040; **IBUNAM** AR5446, 5447, AR8316; **KU** 29768, 37797–37799, 37800, 73893–73895, 104196; **LACM** 6407, 6408, 6411–6415, 6504–6507, 8709–8714, 25632, 25633, 36902–36911, 90186, 90187, 90188, 90189, 90190, 90191, 90192–90194, 90195, 91732; **LSU** 37587, 37588, 67899, **MSUM** HE.8834; **MVZ** 71225; **TCWC** 12320, 12321; **UAZ** 19502, 19503, 19504, 19505, 19506, 19507, 19508, 19509, 19510–19513, 19514, 19515, 19516, 19519, 19583–19585, 19586, 19587; 19589; **USNM** 47442, 238091–238093, 238094–238101, 128102, 238103; **UTEP** 5194, 5453–5455; Fieldwork of the present study: **UTADC** 8159.

Tlalocohyla smithii: **MVZ** 71214, 71215, 77902; **USNM** 238002–238015, 238082, 238083–238086, 238087, 238088, 238089, 238090,

196316. Fieldwork of the present study: **UTADC** 8160.

Trachycephalus thyponius: **KU** 73879, 74339, 104189; 153705–153708; **LACM** 76595, 90069–90084, 180780; **LSU** 67617–67619; **UTEP** 6626, 6627.

Eleutherodactylus nitidus: **CAS** 17447; **IBUNAM** AR9383, AR1695, AR1696; **KU** 37831, 37832, 60238, 60239; **LACM** 90537, 90538, 90539–90543; **MSUM** HE.8835; **TCWC** 12735, 12746–12752, 12754, 12755, 12756, 12757, 112758; **UAZ** 08238, 08240; **UCM** 41342; **UTEP** 5439; Fieldwork of the present study: **UTADC** 8143.

Eleutherodactylus pallidus: **IBUNAM** AR8313. Fieldwork on this study: **UTADC** 8144.

Eleutherodactylus teretistes: **IBUNAM** AR8317; **UCM** 50983; **UTEP** 6628–6630, 6954–6959, 6988, 6989; Fieldwork of the present study: **UTADC** 8145.

Leptodactylus melanonotus: **CAS** 132141–132457, 95707–95709, 135350, 135351, 95664, 95710, 95711–95713, 97067–97335, 97737, 97373–97375, 97384–97390, 99152–99159, 99184, 99187–99200, 99214–99246, 99516, 99551, 99562, 17041–17045, 17046–17055, 17450, 17451; **IBUNAM** AR7882, AR8132, AR8237, AR8246, AR8315, AR9382; **KU** 28145–28147, 29894, 29895, 29897, 29896, 29898, 29899, 67953–67955, 73817, 73818; **LACM** 2094, 2095, 6221, 6227–6232, 8696–8707, 37042, 37043, 37280–37282, 64833, 64150, 64909–64926, 90361–90364, 90365, 90366, 90367, 136845, 136846; **LSU** 30933, 68019–68039, 68040–68051; **MCZ** A-29638; **MPM** 5349–5351, 5352–5356; **MSUM** HE.7155–7157, HE.10517; **MVZ** 65545–65561, 70229, 70230, 72110, 72111–72113, 72114, 72115, 75771–75776; **TCWC** 12181–12191, 74498; **UAZ** 08172, 08175, 08173, 08174, 08176, 36580, 38386, 38387, 42451; **USNM** 134272, 238016; **UTEP** 7936; Fieldwork of the present study: **UTADC** 8152.

Gastrophryne mazatlanensis: **CAS** 99583; **MVZ** 144017; **USNM** 238115.

Hypopachus ustum: **CAS** 95662; **LACM** 74768; **LSU** 37874, 37875–37880; **TCWC** 75026; **USNM** 238117, 238116.

Hypopachus variolosus: **CAS** 17787, 51152; **IBUNAM** AR 5457, 5458, AR8321; **KU** 29765, 29766, 68045, 68046, 68047, 68048, 104204; **LACM** 25639, 36912–36949, 178116, 90563, 90564, 90565–90585, 90586–90588, 90589, 90590–90600, 90601–90614, 90615, 90618, 90616, 90617, 170334, 170335, 178476; **LSU** 68705–68707; **MCZ** A-28359; **MVZ** 76101, 76102, 76103, 144018, 144019; **TCWC** 13003, 13004, 13005, 13006; **UAZ** 10306–10310, 10313, 10331, 10332, 10334–10336, 10337, 10338, 10339, 10344, 10341, 10342, 10344, 10347, 37997; **UCM** 15598–15600; **USNM** 134271; **UTEP** 6985; Fieldwork of the present study: **UTADC** 8149.

Lithobates catesbeianus: **CNAR-IBH** 26891, 26892.

Lithobates forreri: **CAS** 103411, 103412, 135356, 94259, 95701, 95703, 97064–97066, 97261, 99186, 17056–17059; **IBUNAM** AR4082, AR4083, AR4084, AR4085, AR4087, AR7883, AR7892, 8061, AR7901; **LACM** 135408, 135409; **LSU** 70212, 70214, 70223, 238023–238025; **USNM** 238130, 238131, 238132, 238133, 238134; Fieldwork of the present study: **UTADC** 8153.

Lithobates magnaocularis: **CAS** 89760; 95692, 95704, 95705, 99213–99239, 99705, 99254, 99492, 99493, 99511–99513, 99691, 17452–17457; **KU** 29864, 29866, 29867, 29869–29872, 37991, 62395, 73948; **LSU** 38066; **MVZ** 72119; **UTEP** 5743, 5744, 5745, 5746; Fieldwork of the present study: **UTADC** 8154.

Lithobates megapoda: **AMNH** 68056–60, 64142–47, 60438–39, 67468–69; **CAS** 17060–17066; **LSU** 90936–90938; **UTEP** 4592.

Lithobates psilonota: **MZFC** 17290; **UTA-A** 56778.

Lithobates pustulosa: **CAS** 91976–91981, 95693, 95394, 95706, 99494–99500; **LACM** 1794–1796, 65029; **IBUNAM** AR7894, 8060, AR8059, AR9384–9387, 9391, 9392, 9394, 9395, AR9388, 9389, AR9390, AR9393, 9396; **KU** 73959; **LSU** 38227–38236; **UTEP** 6532, 6961–6966, 7580, 7588, 7589; Fieldwork of the present study: **UTADC** 8155.

Scaphiopus couchii: **USNM** 47859, 47860, 47861, 47862, 47863, 47864.

Spea multiplicata: Fieldwork of the present study: **UTADC** 8136.

Ambystoma rosaceum: **MZFC** 17662. Fieldwork of the present study: **UTADC** 8102.